

DE12, DE12T & DE12TI & DE12TIS DIESEL ENGINE

Shop Manual

65.99892-8030B

Daewoo reserves the right to improve our products in a continuing process to provide the best possible product to the market place. These improvements can be implemented at any time with no obligation to change materials on previously sold products. It is recommended that consumers periodically contact their distributors for recent documentation on purchased equipment.

This documentation may include attachments and optional equipment that is not available in your machine's package. Please call your distributor for additional items that you may require.

Illustrations used throughout this manual are used only as a representation of the actual piece of equipment, and may vary from the actual item.

FOREWORD

This manual has been prepared to help you use and maintain the DE series diesel engines (DE12, DE12T, DE12TI and DE12TIS) safely and correctly.

These economical and high-performance diesel engines(6 cylinders, 4 strokes, in-line, direct injection type) have been designed and manufactured to be used for overland transport or industrial purpose. They meet all the requirements such as low noise, fuel economy, high engine speed and durability.

Nonetheless, to obtain the best performance and long life of an engine, it is essential to operate it appropriately and to carry out periodic checks as instructed in this manual. You are requested to thoroughly read this manual from cover to cover and to acquaint yourself with all the information contained in this manual.

All information, illustration and specifications continued in this literature are based on the latest product information available at the time of publication approval. The right is reserved to make changes at any time without notice.

Please contact Daewoo dealer for the answers to any questions you may have about DE series engine's features, operation or manuals.

CONTENTS

1. General information	1
1.1. Engine characteristics	1.4. Engine performance curve
1.2. Main data and specifications	1.5. Exterior view of engine
1.3. Engine specification('98 type)	
2. Major maintenance	22
2.1. Preventive maintenance	2.2. Diagnostics and troubleshooting for the engine
3. Disassembly and reassembly of major components	37
3.1. Disassembly	3.3. Reassembly
3.2. Inspection	3.4. Breaking-in
4. Maintenance of major components	79
4.1. Cooling system	4.3. Fuel system
4.2. Lubricating system	4.4. Turbocharger
5. Scan pole diagnosis for DE12TIS	142
5.1. Wire harness connection	5.4. Sensor data
5.2. System & Vehicle selection	5.5. Actuator test
5.3. Self-diagnosis(current)	5.6. Flight record
6. Maintenance specifications	154
6.1. Tightening torque	6.2. Maintenance specification table

● WORLDWIDE NETWORK

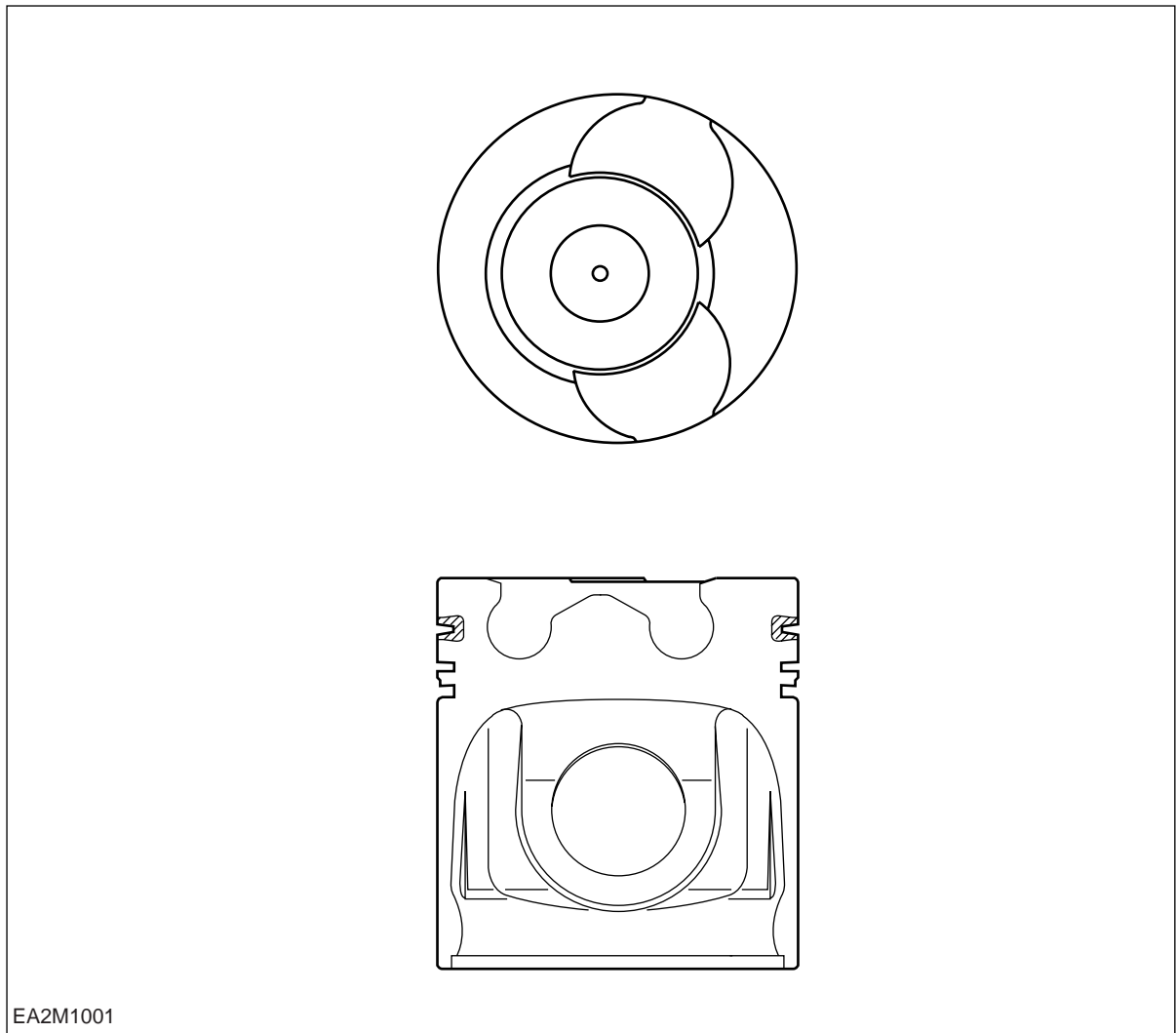
1. General information

1.1. Engine characteristics

1.1.1. OMEGA combustion bowl

The OMEGA combustion bowl is a unit designed to perform high-efficiency, low- emission combustion. As the rim around the combustion bowl port of the upper of the piston has been machined in a smaller size than the interior of the combustion bowl, strong swirl is produced in the combustion bowl and strong squish flow makes the fuel be mixed more sufficiently with air.

Due to the application of OMEGA combustion system and optimal utilization of intake and exhaust port configuration within the cylinder head, the DE12 series engines discharge a very low level of hazardous exhaust gases such as smoke, nitrogen oxide, hydrocarbon, or carbon monoxide and thus ensure high performance and low fuel consumption.



EA2M1001

<Figure. 1-1> OMEGA combustion bowl

1.1.2. Wastegated turbocharging system

1) What is the wastegated turbocharging system?

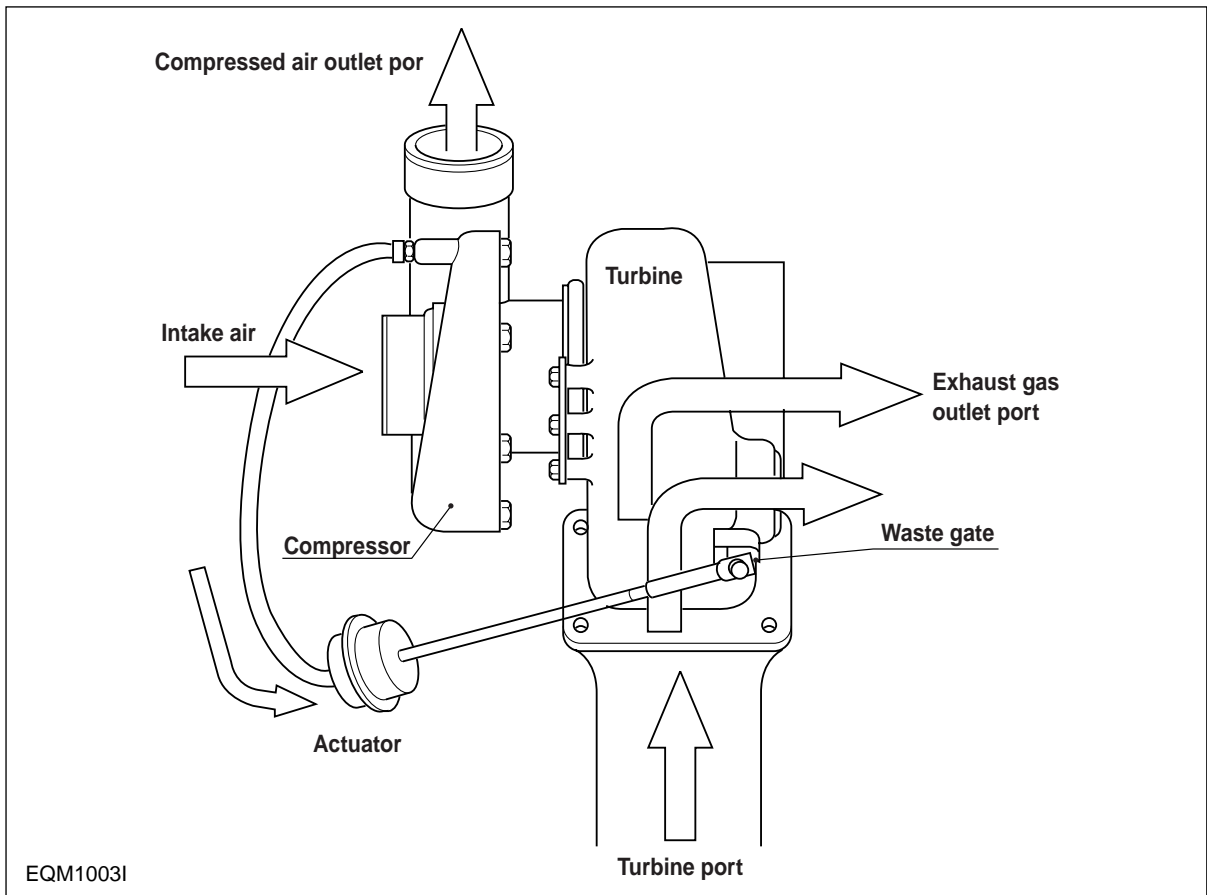
Turbocharger is a system designed to pressurize the intake air to increase engine output and decrease fuel consumption by using the energy of exhaust gas discharged from the engine. However, the turbocharger has a weak point at low engine speed, its performance may drop, thus performance at low speed is relatively low.

The WASTEGATED TURBOCHARGING SYSTEM is an up-to-date turbocharging system remedying such a defect, and the working principle is as follows:

A small-sized high performance turbine is used to improve engine performance at low speeds. As high charging efficiency can be obtained even if a small amount of exhaust gas is present at low speed. On the other hand, if higher charging pressure is produced than what is present at high speed, fuel consumption increases. To correct this, part of exhaust gas is forced to be discharged into the exhaust manifold through the waste gate, not through the turbine.

The waste gate is controlled by the ACTUATOR mounted in the turbocharger, and if the pressure in the turbocharger becomes higher than what is required for the engine, the waste gate is forced to open.

2) DE12T, DE12TI and DE12TIS engines are featured by the application of turbocharger so that the torque in low speeds can be increased by 30% or more, not only to create high performance, just from the time of starting off the vehicle but also to greatly reduce fuel consumption.



<Figure 1-3> Turbocharger

1.2. Main data and specifications

Engine Model	DE12	DE12T	DE12TI	DE12TIS
Type	In-line, 4-stroke, vertical type			
Combustion chamber type	OMEGA Combustion bowl			
Fuel injection	Direct injection type			
Bore X stroke-No. of cylinders	123mm X 155 - 6			
Total displacement	11,051cc			
Compression ratio	17.1:1	17.1:1	16.5:1	16.8
Maximum power(PS)	225 ps/2,200 rpm	300 ps/2,200 rpm	340 ps/2,100 rpm	←
Maximum torque	81.5 kg·m/1,400 rpm	110 kg·m/1,300 rpm	135 kg·m/1,260 rpm	←
Injection timing	12° BTDC	9° BTDC	12° BTDC	1.0° BTDC
Firing order	1-5-3-6-2-4	←	←	←
Injection pump type	S3000	S3000	S3S	HD-TICS
Governor type	RFD-C/RLD	RFD-C	RFD-D	RLD-J
Timer type	SP	SP	SPG	Electronically control
Nozzle type	Multi-hole type(5-φ0.29)	Multi-hole type(5-φ0.31)	Multi-hole type(5-φ0.33)	Multi-hole type(5-φ0.29)
Feed pump type	K-P	K-P	K-PS	←
Valve Timing				
Intake valve open at	BTDC 18°	←	←	BTDC 18°
Intake valve close at	ABDC 34°	←	←	ABDC 32°
Exhaust valve open at	BBDC 46°	←	←	BBDC 70°
Exhaust valve close at	ATDC 14°	←	←	ATDC 30°
Oil pump type	Gear type	←	←	←
Oil cooler type	Water-cooler	←	←	←
Fuel filter type	Full flow type	←	←	←
Oil capacity	20ℓ(Oil pan 17ℓ)	←	←	←
Coolant capacity	19ℓ	←	←	←
Thermostat type	Wax-pallet	←	←	←
Starter : Voltage-output	24V-6.0Kw	←	←	←
Alternator : Voltage-capacity	24V-45A	←	←	←

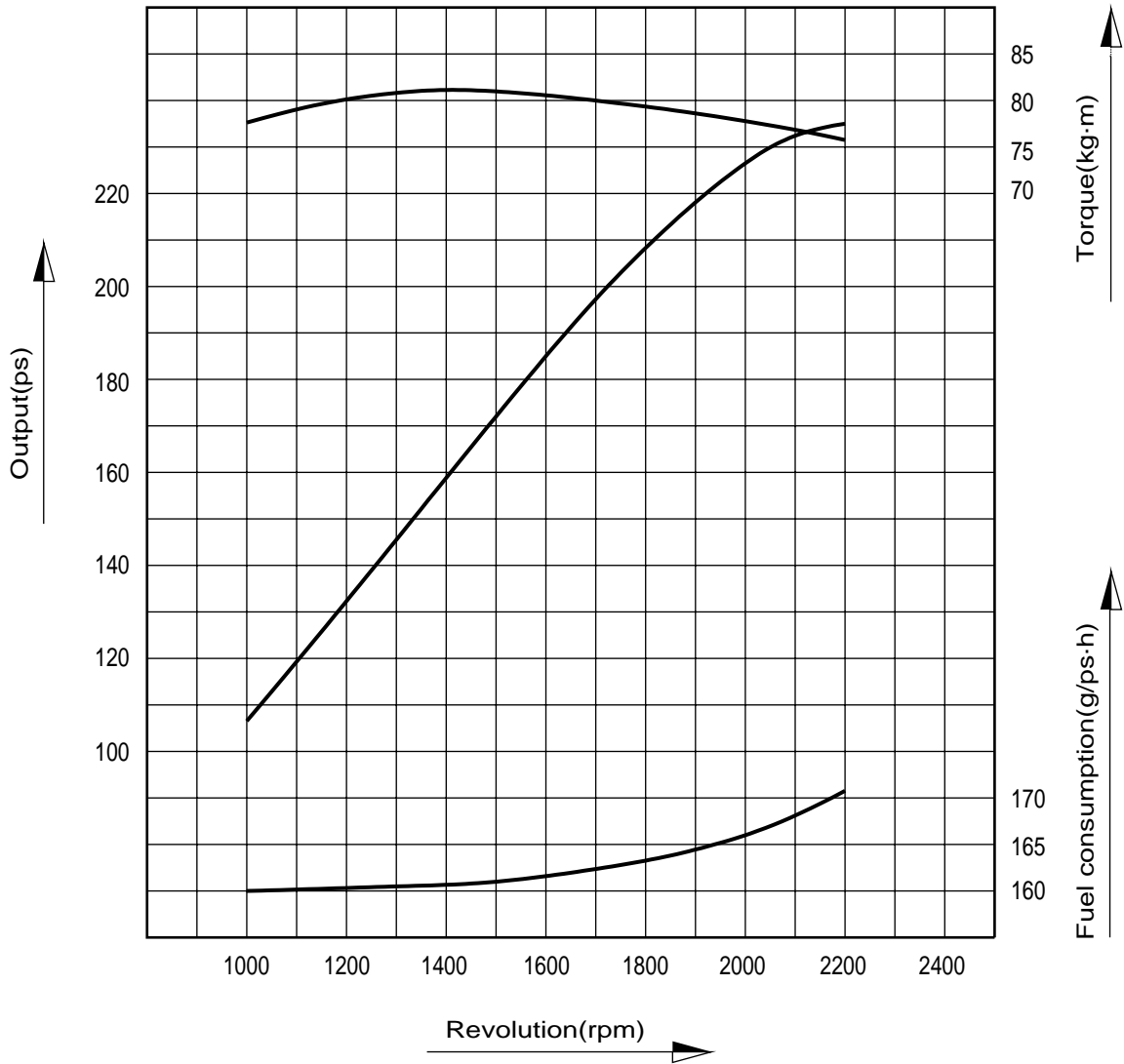
1.3. Engine specification('98 type)

Item		DE12-228	DE12TI-280	DE12TI-310	DE12TIS		
E n g i n e	Manufacturer	DHI	←	←	←		
	Mounting location	Under Seat	←	←	←		
	Starting type	SELF	←	←	←		
	Engine type	Diesel 4 Cycle	Turbocharged & Intercooled	←	←		
	Cylinder(No. arrangement)	In-line, vertical	←	←	←		
	Combustion chamber type	Direct injection	←	←	←		
	Valve position	OHV	←	←	←		
	Diameter x stroke	123x155	←	←	←		
	Compression ratio	17.1	16.1	←	16.8		
	Comp. pressure(kg/cm ² -rpm)	28-200	←	←	←		
	Average efficient comp.(kg/cm ²)	9.27	13.08	14.21	←		
	Max. horse power(ps/rpm)	228/2,200	280/2,100	310/2,100	340/2,100		
	Max. torque(kg•m/rpm)	80/1,400	115/1,260	125/1,260	140/1,260		
	Firing order	1-5-3-6-2-4	←	←	←		
	Engine dimension(LxWxH)	1,317x747x1,015	1,317x847x1,064	←	←		
	Dry weight(kg)	872	909	910	←		
	Cycle	4	←	←	←		
	Piston Material	AL	←	←	←		
	No. of piston ring	Comp. ring	2	←	←	←	
		Oil ring	1	←	←	←	
	In. & Ex. Valve timing	Intake	Open	BTDC 18°	←	BTDC 18°	
			Close	ABDC 34°	←	ABDC 32°	
		Exhaust	Open	BBDC 46°	←	←	BBDC 70°
			Close	ATDC 14°	←	←	ATDC 30°
	Valve clearance (cold engine)	Intake	0.3	←	←	←	
		Exhaust	0.3	←	←	←	
	Lubricating system	Engine speed at no load	550-600	←	←	←	
		Lubricating Type	Forced pressure type	←	←	←	
Oil pump type		Gear	←	←	←		
Oil filter type		Strainer	←	←	←		
Oil capacity(ℓ)		20	←	←	←		
Oil cooler type		Water cooled	←	←	←		

Item		DE12-228	DE12TI-280	DE12TI-310	DE12TIS		
Engine	Turbocharger type		-	Exhaust gas driven	←	←	
	Intercooler type		-	Air cooled	←	←	
	Cooling system	Cooling type	Forced water circulation	←	←	←	
		Coolant capacity	19(engine only)	←	←	←	
		Water pump type	Centrifugal	←	←	←	
Thermostat type		Wax pellet	←	←	←		
Fuel system	Fuel pump type		Plunger	←	←	←	
	Fuel filter type		Full flow	←	←	←	
	Fuel injection type		Mechanical	←	←	Electronic control	
	Inj. pump system	Type		Inline	←	←	←
		Timing		BTDC 8°	BTDC 12°	←	BTDC 1.0°
		Plunger Dia.		12	←	←	←
		Cam lift(mm)		11	12	←	14
	Inj. nozzle	Nozzle mounting		Flange	←	←	←
		Nozzle type		Multi hole	←	←	←
		Orifice	No	5	←	←	←
			Dia.(mm)	0.29	0.33	←	0.29
Inj. pressure(kg/cm ²)		220	130/220	←	163/224		
Electric system	Voltage(V)		24V	←	←	←	
	Preheat-ing system	Type	Electric	←	←	←	
		Voltage(V) - Amp(A)	22-120	←	←	←	
	Alternator	Output(V-A)		-	-	-	-
		Regulator		-	-	-	-
	Starter	Type		Reduction	←	←	←
		Output(kW)		24V-6.0kW	←	←	←
	Ignition	Type		Air compression	←	←	←

1.4. Engine performance curve

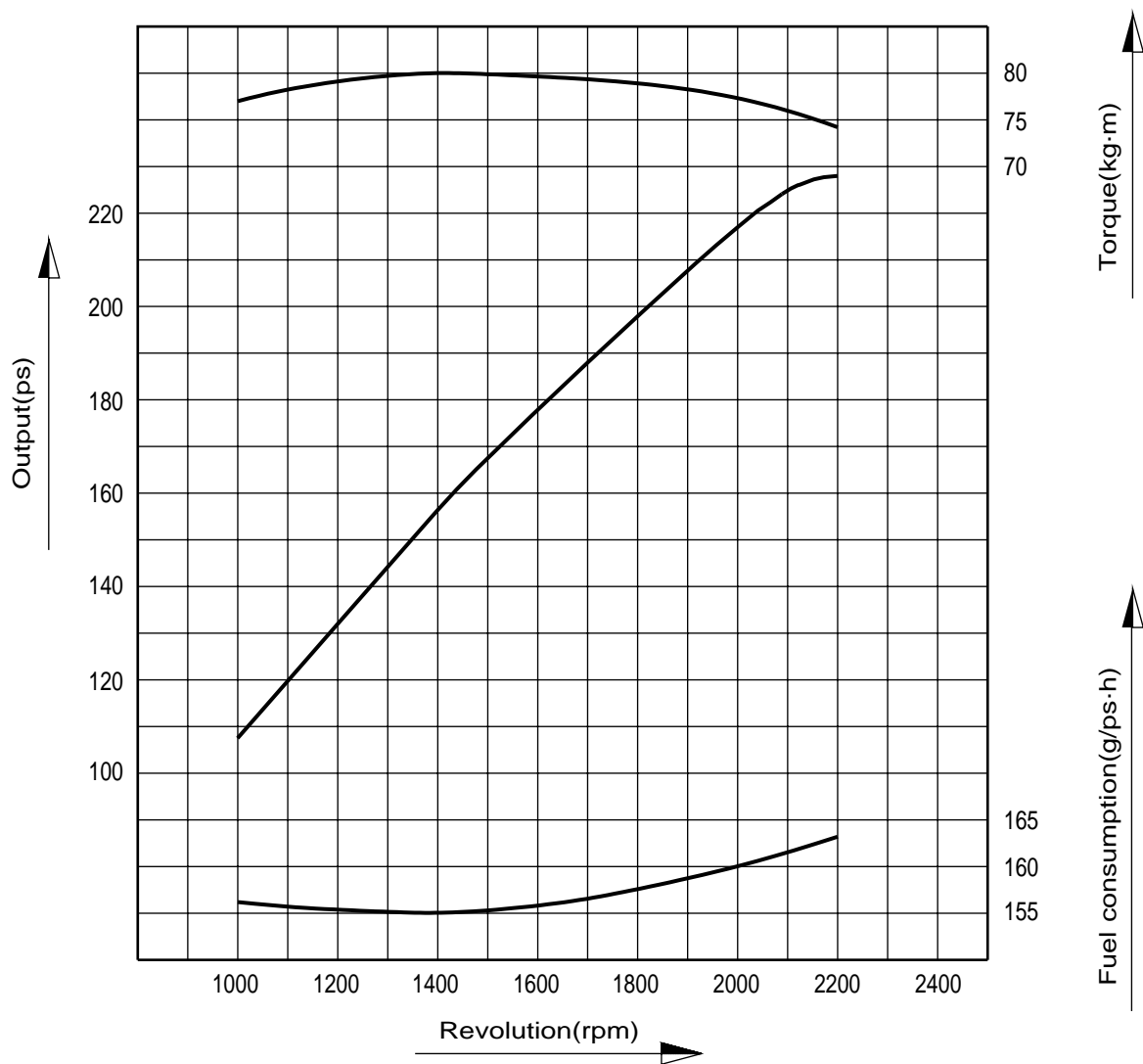
1.4.1. DE12



Performance criteria	ISO 1585(SAE J1349)
Output(Max.)	235 ps/2,200 rpm
Torque(Max.)	81.5 kg·m/1,400 rpm
Fuel consumption ratio(min.)	160 g/ps·h

EQM1004I

1.4.2. DE12('98 type)



Performance	ISO 1585(SAE J1349)
Output(Max.)	228 ps/2,200 rpm
Torque(Max.)	80 kg·m/1,400 rpm
Fuel consumption ratio(min.)	155 g/ps·h

EQM1005I